

QUARTERLY SUMMARY

OF THE

IMPROVEMENTS AND DISCOVERIES

IN THE

MEDICAL SCIENCES.

ANATOMY AND PHYSIOLOGY.

1. *On a new Form of Smooth or Non-Striated Muscular Fibre.*—Prof. KÜLLIKER describes the smooth muscles as composed of short, isolated fibres, each containing a nucleus. He calls them muscular or contractile fibre-cells, and gives three varieties:—

1. Short, round, spindle-shaped, or rectangular plates, like those of epithelium, $0.01''$ long, and $0.006''$ broad.

2. Long plates of irregular, rectangular, spindle or club-like shape, with fringed edges, $0.02''$ long, and $0.003''$ broad.

3. Narrow, spindle-shaped, round, or flat fibres, with fine ends which are either straight or wavy, $0.02''$, or even $0.25''$ long, and $0.002''$ to $0.01''$ broad.

The first and second of these forms are only to be found in the walls of vessels; the first may be mistaken for the cells of epithelium.

These muscular fibre-cells are composed of soft light yellow substance, which swells in water and acetic acid, in which last it becomes of a paler colour. There is no appreciable difference between the outer and inner parts; though in acetic acid it would seem as if each fibre-cell had a delicate covering. Their substance is homogeneous, with longitudinal stripes; and they often contain small pale granules, sometimes yellow globules of fat. Each fibre-cell has without exception a pale nucleus, sometimes only perceptible in acetic acid. Its form is peculiar, being like a small staff rounded at each end. The substance of the nucleus is homogeneous; its length is $0.006''$ — $0.004''$; its breadth $0.0008''$ — $0.00013''$. The muscular fibre-cells lying side by side or end to end, form the smooth muscles as they appear to the naked eye. They may be divided into:—

1. Purely smooth muscles containing no other tissue: such are those of the nipple, corium, of the interior of the eye, of the intestines, of the perspiratory glands of the axilla, of the cerumen glands of the ear, of the bladder, of the prostate, of the vagina, of the small arteries, of the veins and lymphatics.

2. Mixed smooth muscles, which contain, besides the muscular fibre-cells, cellular tissue, nuclear fibre, and elastic fibre: such are the traheculæ of the spleen and corpora cavernosa of both sexes. They are also found in the tunica dartos, gall-ducts, the fibres of the trigonum vesicæ, the circular fibres of the larger arteries and veins, the long and transverse fibres of the prostata, urethra, Fallopian tubes, and of the womb; they change by imperceptible transitions into the first form; this is the case in the trachea, bronchi, urethra, the inner muscular layer of the testicles, seminal ducts, &c.

Küllikow says, that he has found smooth muscles in the skin to a far greater extent than is generally supposed. In the subcutaneous cellular membrane of the scrotum, penis (prepuce), and the anterior portion of the perineum, they are well developed. The greater number seems to exist in the tunica dartos;

in the perineum and prepuce there are fewer. In the tunica dartos, they form a muscular coat resembling, on a small scale, the tissue of the bladder. In the nipple and areola (especially in the female), the smooth muscles are strongly developed, somewhat resembling those of the tunica dartos, but having no fibrous covering. In the areola, up to the base of the nipple, they are arranged in circular order; in the nipple, they are circular and vertical, the ducts passing between them. Some lie in the corium and form the corpus reticulare; others belong to the subcutaneous tissue. Smooth muscles are also found in every part of the body covered with hair, in the hair-bulb, and in the upper portion of the corium. In the parts not covered with hair, such as the palm of the hand, the smooth muscles are wanting. One or two bundles of muscular fibre encircle each hair-bulb or sebaceous gland. Kölliker remarks that the tensor choroideæ does not insert itself into the processus ciliaris, but that it lies flat on its anterior surface, and that it arises from the canalis schlemmii. The sphincter pupillæ, he says, may be easily seen in the eye of the white rabbit, and in the blue eye in man, on removing the uvea. In man it is $\frac{1}{3}$ " broad, and forms the pupillar edge of the iris. He has also observed a muscular ring near the annulus iridis minor. The dilator pupillæ does not form a continuous membrane, but seems to consist of isolated bundles of fibres passing between the muscles to insert themselves in the edge of the sphincter. He has never seen the anastomosis of these fibres mentioned by Todd and Bowman. The writer thinks that the elements of all these muscles are smooth muscular fibre, though he admits that he has seldom succeeded in isolating the muscular fibre-cells in the human body. He does not think that the M. cochlearis discovered in the ear by Todd and Bowman deserves the name of a muscle; he is rather disposed to consider it as a ligamentous structure, and calls it the ligamentum spirale; he looks upon it as a means of attachment for the zonula membranacea. Remarking that the smooth muscles of the intestines resemble one another in their histological characters, he points out one peculiarity, viz., that they present a knotty appearance with ends running out into fine spirals. He thinks that it is not improbable that the knots are due to a contraction of the fibre. The fibre-cells of the intestine seem to be striped as if they were composed of an envelop and some homogeneous striped contents. No nuclear fibre is found among them, but they are covered and bound together by cellular membrane.

The small perspiratory glands seldom possess smooth muscular fibres, although these are always present in the large perspiratory glands of the axilla, and in the cerumen glands of the ear.

Kölliker does not admit the presence of muscular fibre in the lacteal glands.

In the lungs, he finds that the structure of the small and large bronchi is the same. Outside of the epithelium, they present a layer composed of longitudinal fibres of areolar tissue, and a number of strong, fine elastic fibres. Then follow one or more circular layers of smooth muscular fibre, with some nuclear fibre running transversely; lastly, a layer of cellular tissue, with nuclear fibre. He never could find muscular fibre running longitudinally through the bronchi. With respect to the vesicles of the lungs, he could come to no satisfactory conclusion. Long nuclei are seen in the walls of the vesicles, but they are not so long and narrow as those of the smooth muscles, and appear to him to belong to the capillaries. The smooth muscles of the trachea and bronchi resemble in their elements those of the intestines. In the ox, the gall-bladder, the ductus cysticus, d. choledochus, and the ducts lying out of the substance of the liver, present a large amount of muscular fibre of the smooth species. It is strongly developed in the canals, in which it is so disposed longitudinally; in the gall-bladder this is not so much the case, a transverse, and even an oblique layer of fibres being placed between the two longitudinal layers. In the human body, the muscular structure is very faintly developed in the gall-ducts. Kölliker could only discover a very delicate layer at all approaching muscular fibre. In the pancreatic ducts of the human body, no trace of muscular fibre exists. In the lachrymal apparatus, there are no muscular fibres; in the ductus stenonianus, none; the ductus whartonianus has a very faint layer of smooth muscular fibre.

No part of the internal structure of the kidney shows traces of muscular

fibre; it is only in the calices and pelves that it becomes apparent. The muscular fibres of the pelves and calices are composed of an outer longitudinal coat, and an inner transversal layer; they are continuations of the same in the urethra, and all partake of the general characters of smooth muscular fibre. Supposing the disposition of the muscular fibres of the bladder to be well known, the writer observes that the trigonum vesicæ consists of a pretty strong layer of pale yellow fibres immediately under the mucous membrane; this is to be considered as an expansion of the longitudinal fibres of the urethra.

The canaliculi of the testes have no muscular fibres, but on the inner side of the interior surface of the tunica vaginalis communis, smooth muscular fibre is evident. The vas deferens presents a thick layer of smooth muscular fibre, forming an outer longitudinal, a middle transverse, and an oblique layer directly under the mucous membrane. The canaliculi of the epididymis present the same conditions of their walls as the vasa deferentia. Kölliker thinks he has seen some muscular fibres in the body of the epididymis. The ductus ejaculatorii are formed like the vas deferens; the seminal vesicles present also the same conditions. Both coverings of the prostate that derived from the seminal vesicles, and its own peculiar covering, are more or less muscular.

The pars membranacea urethræ possesses but little smooth fibre, compared with the prostate. Under the mucous membrane (whose cellular tissue is rich in elastic or nucleus-fibre) there is a layer of longitudinal fibre, mostly composed of fibre-cellular membrane, containing nuclear fibre and contractile fibre-cells; this layer is succeeded by another of transverse fibre belonging to the musculus urethralis; it also contains smooth muscular fibre. In the pars cavernosa urethræ the fibres are but slightly developed; but they are still found at a certain depth.

The corpora cavernosa may be considered as highly developed muscular structures, furnished with peculiar blood-vessels, since the smooth muscular fibres exist in the fibrous septa even in the glans.

The inner portions of the uropoietic viscera in the female resemble those of the male with regard to their structure. The urethra has, besides the longitudinal fibres, a transverse layer of smooth muscular fibre. The Fallopian tubes have a thick middle layer of longitudinal and transverse fibre; the elements of which are smooth muscular fibre-cells, with moderate-sized nuclei. The smooth muscular fibre is with difficulty isolated in the virgin state; but in the gravid uterus it is seen in great perfection. In the fifth month, Kölliker saw bundles of red fibre of the smooth muscular kind, mixed with cellular membrane, without nucleated fibre; the fibre-cells were spindle-shaped, and very long. As pregnancy advances, no new cells seem to form; but those already formed increase in size. Sometimes they measure $\frac{1}{16}$ "— $\frac{1}{4}$ "; they are spindle-shaped, and run out into long, thin tails. After birth, they rapidly decrease in size. The middle or vascular layer of the uterus is rich in smooth muscular fibre; it differs only from the inner and outer coat, in the fibres crossing each other in every direction.

The ligamenta uteri anteriora et posteriora present a red fibrous tissue, enclosed in the two folds of the peritoneum; in this, smooth muscular fibre may be traced. In the ligamenta ovarii, very few are found. The ligamenta rotunda contain smooth muscular fibre: during pregnancy, they swell; and then the fibres seem to increase in size. The writer says he has seen muscular fibre in the lower portion of the anterior fold of the peritoneum; on the ligamenta lata these fibres expand between the folds, and he even thinks that they insert themselves in the walls of the pelvis. Directly under the mucous membrane of the vagina, a layer of muscular fibre exists stretching from the bottom of the vagina to the vestibule, and containing a thick plexus of veins; it is composed of longitudinal, but more especially of transverse, long fibre-cells with wavy ends. The structure of the clitoris, glans clitoridis, bulbus vestibuli, &c., is analogous to that of the corpora cavernosa in the male.

In the spleen of the human body, Kölliker has never been able to discover smooth muscular fibre, either in its covering, or in the larger fibrous bands; but in the microscopical fibrous bands he has found elements which he thinks are of a muscular nature. He also states that in birds, reptiles, and fishes he

has found some muscular fibre in the fibrous bands of the spleen. The existence of smooth muscular fibre in the blood-vessels and lymphatics is indubitable; Kölliker recommends the middle-sized arteries and veins for examination. In the aorta and trunks of the pulmonary arteries, the middle coat is composed alternately of muscular and elastic membrane, with fibro-cellular tissue. These muscles consist of fibre-cells, containing nuclei. The larger veins of the human body present, externally to their lining, a single or double layer of elastic fibre, a simple coat of transverse muscular fibre-cells, mixed with cellular tissue, to which succeeds externally a coat of longitudinal fibres. In the middle-sized veins, there is a middle coat of a pale reddish colour, composed of alternate transverse and longitudinal fibres; the former are of fibro-cellular tissue, and contractile fibre-cells. Towards the periphery, the muscular structure decreases. The veins of the uterus, which in the unimpregnated state present no peculiarities, acquire a great development during pregnancy with regard to length and organization. This does not so much proceed from the thickening of their walls as from the increasing size of the fibre-cells existing in the middle coat before pregnancy, and in certain changes in the outer and inner coat caused by their acquiring a considerable quantity of smooth muscular fibre. The very large veins which pierce the inner muscular coat of the uterus at the point of attachment of the placenta, and which communicate with its uterine portion, make an exception to this rule, as they have only longitudinal muscular coats, which with the epithelium form the walls of the vein.

The following veins have no muscular structure:—

1. The veins of the uterine portion of the placenta.
2. The veins of the cerebral substance, which are formed of epithelium and cellular membrane.
3. The sinuses of the dura mater.
4. Breschet's veins of the bones.
5. The venous cells of the corpora cavernosa in the male and female.
6. Probably the venous cells of the spleen. The muscular fibres of the lymphatics are like those of the veins; they exist sparingly in the trunks, and in greater number in the smaller branches.—*Kölliker and Siebold's Zeitschrift*, 1849.

[We have given this full analysis of Professor Kölliker's laborious researches on the new form of organic muscular structure discovered by him, on account of the importance which we attach to his results. It is obvious that the long fibre-cells, which he was the first to describe, constitute the simplest form of the proper contractile tissue of animals, save that nearly homogeneous nucleated blastema which seems to constitute a yet earlier stage in organic development. The lengthened non-striated fibre may be conceived to owe its origin either to the elongation or to the coalescence of these fibre-cells, as indicated by their persistent nuclei. And in the highest form of muscular fibre, the contractile power no longer exists in the original or parent-cells, but is delegated to the fibrillæ generated within them, each of which consists of a linear series of cells of much more minute size, probably holding the same relation to the series of parent-cells, of which the entire fibre seems to be composed, as the secreting-cells of a gland do to the follicle within which they are generated.]—*Brit. and For. Med.-Chirur. Rev.*, July, 1850.

2. *Structure of the Membrana Tympani in the Human Ear.*—Mr. JOSEPH TOYNBEE, in a paper read at the Royal Society on the 20th June, describes the membrana tympani as consisting of the following layers, quite distinct from each other, both as regards their structure and functions.

1. Epidermis.
2. The proper fibrous layer, composed of
 - a. The lamina of radiating fibres.
 - b. The lamina of circular fibres.
3. Mucous membrane.

One of the principal objects of the paper is to describe the structure and functions of the fibrous laminae. Since the time of Sir Everard Home, who

pronounced the layer of radiating fibres to be muscular, anatomists have differed in their views of the nature of the fibrous element of the membrana tympani. The lamina of radiating fibres, the outer surface of which is covered by the epidermis, is continuous with the periosteum of the external meatus. With the exception of the uppermost fibres, which, on account of their being somewhat flaccid, have been considered as a separate tissue, under the name of "*membrana flaccida*," the radiate layer is composed of fibres which extend from the circular cartilaginous ring to the malleus, and they interlace in their course. These fibres are from the 4000th to the 5000th parts of an inch in breadth.

The lamina of circular fibres consists of fibres, which are firm and strong towards the circumference, but very attenuated towards the centre. These fibres are so attached and arranged as to form a layer of membrane which, in a quiescent state, is saucer-shaped. The fibres composing the circular are smaller than those of the radiate lamina, being from the 6000th to the 10000th part of an inch in breadth.

The facts that appear to be adverse to the idea of the fibres of either layer being muscular are:—

1. The absence of distinct nuclei in the fibres.
2. Their great denseness and hardness.

The four laminae forming the membrana tympani are continuous with the other structures, of which they appear to be mere modifications, and not one is proper to the organ.

The tensor tympani ligament, which had not been previously noticed by anatomists, is particularly described by Mr. Toynbee in the paper read before the Royal Society. It is attached externally to the malleus, close to the insertion of the tensor tympani muscle, and internally to the cochleariform process.

The latter part of the paper is occupied by observations on the functions of the fibrous laminae, and of the tensor ligament of the membrana tympani; and it is shown that by these two antagonistic forces, the one tending to draw the membrana tympani outwards, the other inwards, this organ is maintained in a state of moderate tension, and is always in a condition to receive ordinary sonorous undulations.—*London Journ. Med.*, Aug. 1850.

3. *Structure of the Liver*.—Professor RETZIUS has examined the liver in the human being, in the dog, cat, rabbit, squirrel, pig, and ox; and his researches have been, on the whole, confirmatory of the views of Mr. Kiernan. He has, some time since, stated his opinion that the liver is originally acinose or lobular, but that, by various changes, the acini or lobules may become confused: but they may regain their distinctness, under favourable circumstances. A portion of the liver of a child six months old was examined. Before injection, the lobules were distinct; but in the injected preparation, where the capillaries were entirely filled, there was no trace of interlobular partitions nor of cellular alveoli. The lobular structure was only shown by the white injection (white-lead), which was forced through the hepatic veins and their lobular branches into the central capillaries of the acini. The acini were thickly surrounded by an abundance of capillaries from the portal vein; but even these did not indicate any distinct limits to the acini. In many places, the lobular capillary network was entirely filled by the injection thrown into it from the portal vein. It was evident from this specimen, that already in the sixth month after birth, the portal venous system, which has during intra-uterine life formed a part of the umbilical venous system, possesses a development far surpassing that of the hepatic vein. In large patches, especially in the right lobe, the injection, which was thrown into the portal veins, occupied the whole of the parenchyma, with the exception of the network of the hepatic ducts, and the central vessel. In other places, the injection had not passed into the finer portal twigs; while the twigs of the hepatic artery, and the adjoining capillaries, were well filled. These arterial twigs gave a lobular or acinose appearance to this portion of the organ. This was especially the case at the surface, where the round ends of the intralobular vascular plexus were raised in the form of small white knots.

The circumference of these lobules was partly uninjected, partly occupied by the network of the hepatic ducts. In the parts which the perilobular injection had not reached, there was an appearance of lobules with large interspaces; but where it had perfectly penetrated, the smaller interlobular plexuses were entirely effaced. Where a longitudinal section had been made through the lobules, they were found, as Kiernan had represented, thickly set on the intralobular (sublobular) twigs, like sessile leaves, surrounded by a portal and biliary capillary network.

Especially interesting, in a well injected preparation, are the ultimate sheaths of Glisson's capsule, which follow the ramifications of the portal vein through the entire organ, until it gives off its perilobular twigs. Professor Retzius has been able to determine a remarkable fact, which Mr. Kiernan, though he had systematically rendered it probable, had not so successfully described—that the biliary ducts form a network in the walls of this sheath, continuous with that in the lobules. The vessels surrounded by this sheath are, a pretty large portal twig, a somewhat smaller twig of the hepatic duct, and a small twig of the hepatic artery. These Glissonian sheaths appear to be situated where one would expect to find the perilobular septa. When the hepatic ducts are well injected, the sheaths are seen like rings, having the colour of the biliary ducts, with their walls covered or interwoven with a capillary biliary network, of as fine meshes as the lobular network. Mr. Kiernan has without doubt seen this, and described it under the name of "vaginal branches" and "plexus." From this vaginal plexus a network of biliary ducts proceeds in all directions, becoming interwoven throughout with the capillary vascular network; it also penetrates into the lobules. The only circumstance in which Professor Retzius differs from Mr. Kiernan, is that the latter describes as twigs or branches the extension of the biliary ducts, while it is in fact a network, in which neither stems nor branches can be distinguished.

The principal results at which Professor Retzius has arrived from the above examination, and from similar examinations of the liver in the lower mammalian, are the following:—

1. That the liver is originally lobular; but that the lobular structure may undergo various changes, and present various appearances of development. There may be confusion of the lobules, in conjunction with more or less regular development of the ramifications of the hepatic vein. That which is most in favour of the presence of the lobular type is the constancy of the alveolar biliary network.

2. That the perfect biliary ducts, with their peculiar walls (the basement membrane of the English anatomists), without which they could not be perfectly injected, are regularly disposed tubes. Professor Retzius has also been able to directly determine the presence of this membrane; and has found it, as described by Schröder van der Kolk, a simple membrane, surrounding the angular as well as the round hepatic cells. This basement membrane may be rendered apparent by macerating a liver in ether, then drying it, and cutting extremely thin slices. These become transparent when laid in water, and exhibit the proper membrane of the finest biliary network in single outline, surrounding the cells.

3. That no arterial network has been found in Glisson's capsule. The regular distribution of twigs from the portal vein and hepatic artery was not perceptible; but the perilobular vessels chiefly appeared as a network; and there appeared no regular or perilobular type in the larger twigs. In two other specimens from children of three years old, elegant hexagonal lobules were seen. In one of these, the injection of the hepatic artery had succeeded remarkably well. Besides the fine long twigs on the surface, each lobule had its own perilobular capillary network, of extreme fineness; but in none of these was the network of the portal vein so distinct, as the injection had penetrated into the network of the lobules, so that the periphery became less distinct. In one of these preparations, the perilobular part of the portal vein was seen giving off triradiate angular branches (*dreizweilige Eckenäste*), as well as the regular peripheral twigs.—*London Journ. Med.*, Jan. 1850, from *Müller's Archiv*. 1849, Heft 2.

4. *A newly-discovered Anastomosis between the Vena Porta and the Vena Cava Inferior.*—M. CLAUDE BERNARD describes the following vascular arrangement which he has discovered, and the use of which he states to be the direct mingling of the abdominal portal blood with the systemic venous blood. Immediately after the portal vein has entered the liver, frequently a little before that, a certain number of branches are detached, and are distributed, some superficially, some more profoundly, in the substance of the liver to the right of the vena cava. The greater number of these branches ramify on the external surface of the vena cava, where, however, they do not constitute *vasa vasorum*, but instead of becoming subdivided into capillaries they abruptly enter the cavity of the vein; either singly, or by the union of several, forming a dilatation or common reservoir which communicates directly with the interior of the vein. These anastomotic vessels are devoid of valves. The walls of these vessels partake of the structural characters of the vena porta; while the branches of the sub-hepatic veins exhibit very distinctly the muscular structure of the hepatic portion of the vena cava inferior. The orifices of these portal vessels are further distinguishable from the sub-hepatic veins by their regularity and their longitudinal direction with regard to the muscular fibres of the vena cava inferior.

This system of direct communication between the vena cava and vena porta does not exist only at the entrance of the liver, but is seen equally extensively in the depth of the organ and on the larger trunks of the hepatic vein, especially in the neighbourhood of their insertion into the trunk of the vena cava inferior. These vessels, M. Coste observed, constitute a true collateral hepatic circulation.—*London Med. Gaz.*, June, 1850.

5. *Influence of Puncture of Medulla Oblongata on the Appearance of Grape Sugar in the Urine.*—Dr. BRINTON brought before the Pathological Society of London (May 20th, 1850), the results of an operation of M. Claude Bernard, who has discovered that puncturing the medulla oblongata on the middle line of the floor of the fourth ventricle, or between the roots of the vagus nerves, gives rise to the appearance of grape sugar in the urine. During a recent visit to Paris, M. Bernard, with great kindness, repeated this and other important experiments in his presence. The pathological interest of the fact, as well as its extraordinary character, led Dr. Brinton to think that the Society might be interested in having it confirmed in their presence. The steps of the operation were detailed to the Society, and illustrated by the skull of a rabbit. Several specimens of urine from a rabbit thus operated on were exhibited to the Society, and in these it was seen that the copper test, which before the operation afforded no precipitate, gave a very copious one immediately after; and that, after enduring several hours, this saccharine state of the urine gradually disappeared. A rabbit was also shown which had been operated on about two hours before the meeting, and whose urine exhibited a copious orange precipitate of the suboxide of copper. A satisfactory, but less copious, precipitate was also obtained from a very small quantity of the secretion taken from the animal while before the Society.

Dr. Benec Jones urged the insufficiency of the copper test. It was evident the operation produced a change in the urine; but he thought the presence of sugar not proved.

Dr. Brinton disclaimed implicit reliance on any single test. M. Bernard had equally assured himself of the presence of sugar by the incontestable proof of fermentation.—*Ibid.*

6. *Determination of the Place of Fecundation in the Superior Vertebrate Animals.*—M. COSTE read to the Academy of Medicine of Paris (June 3d, 1850) a note on this subject, in which he disputed the opinion at present generally held by physiologists, that the ovum, spontaneously discharged, may be fecundated by coming in contact with the semen at any point between the ovary and the external orifice of the uterus. This opinion, M. Coste observed, had been received too readily, on account of its harmonizing with the modern theories of spontaneous ovulation. It has not been noticed, M. Coste remarked, that the ova lose

their integrity at the distance from the ovary that they are said to be capable of fecundation. In order to determine this point, M. Coste had examined the ova of birds and mammalia from ten to twelve hours after their discharge from the ovaries, and had found that those present in the Fallopian tubes, and not fecundated, exhibited evident signs of commencing decomposition. If, then, argued M. Coste, after so short a residence in the tube that they had not traversed the first half of its length, the ova already showed signs of decomposition, it is clear that they can no longer be susceptible of fecundation by contact with the seminal fluid.

M. Coste deduced from his observations that fecundation can only take place at the ovary, the mouth of the Fallopian tube, or in the first third of that canal.—*Ibid.*

7. *Force of Fecundity in Phthisical Subjects.*—Dr. W. H. WALSH, Professor of Medicine in University College, London, with the view of contributing to the solution of the problem, *whether the tuberculous diathesis intensifies or weakens the force of fecundity in the female, and of the procreative faculty in the male*, has collected a certain number of cases of phthisis, carefully noting the number of years the individual had been married, and the number of children and miscarriages the patient herself had had, if a female, or had occurred in the person of his wife if he were a male. As essential elements in the inquiry, the age and the duration of illness at the time of observation were in each instance included. The number of cases amounts to 91; the greater part observed among the out-patients of the Consumption Hospital, when existing in embryo at Chelsea. This number is, doubtless, too small to furnish a final solution to the problem (especially as the investigation is beset with no small number of sources of fallacy), but, nevertheless, may be considered capable of furnishing results approximating to the truth.

It follows from the data which he has collected that the procreative power of phthisical males is below the average—the fecundity of phthisical females materially above it; and hence that, to whatever extent phthisis be a disease propagable from parent to child, the danger of its extension thus is greater from the marriage of tuberculous females than males. It may further be concluded that the tendency to early marriage, which Prof. W. formerly showed to exist in the phthisical of both sexes,* ought, in females, to be discouraged, especially if the researches of future observers should prove that the *phthisis of infants* (differing from that of adults) is, to any prominent degree, an hereditary disease. Early marriage was at one time supposed to be useful to the phthisical female herself; but accurate observation fails to warrant the idea.

But, taking the two sexes together, and regarding them as phthisical stock prepared to propagate, it is obvious that the female activity is counterbalanced, to a certain extent, by the male inactivity.

So that 11.82 years of phthisical cohabitation produce a mean of 0.83 children less than 17.48 years of non-phthisical cohabitation. At the phthisical rate of production, the produce would, in 17.48 years, equal 5.74 children, instead of 4.71, as in the non-phthisical series. This is somewhat above the real excess; still it must be admitted these facts go to prove that there is, to a certain amount, a greater tendency in tuberculous stock to multiply than in the population at large.—*Med. Times*, July 6, 1850.

8. *On the Mechanism of Textural Nutrition.* By RUDOLF HAAS, M. D., late lecturer on Epidemiology in Vienna.—The first step in the actual process of nutrition is, the attraction of the homogeneous part of the blood by the tissues.† The blood being contained in the vessels, that part only which transudes through their walls into the parenchyma of the organs can contribute to nutrition. Hence, even though a large quantity of rich healthy blood be circulating through the vessels, the textures will be imperfectly nourished, unless sufficient exuda-

* Enc. Britan. Ed. 7; Art. Population, p. 423.

† Valentin's Physiologie, Band 2, Sect. 2068. Mueller's Physiologie, p. 75.

tion takes place; but nutrition will be restored so soon as an adequate quantity of blood is made to pass through the walls of the vessels. An excessive exudation of serum into the parenchyma, no doubt, likewise impedes nutrition, by producing pressure on the textures, and thus impeding their attractive power. That this is probably the case, may be inferred from the following considerations: 1. The evolution and nutrition of organs are impeded by pressure from without; and the same effect is no doubt produced by pressure from within. 2. The textures become atrophied, whenever they are pressed on by an adjoining part which has had its bulk enlarged by inflammation or other causes. 3. Inorganic processes are retarded by pressure; thus, crystallization can only take place when sufficient space is afforded. The organic processes, then, consisting in a selection and attraction of similar parts, have the greater need of sufficient space.

The process of nutrition may then be supposed to be modified by all those forces which cause an alteration in the quantity or quality of the blood effused into the parenchyma; or rather by those influences which affect the transudation of the nutritive part of the blood through the coats of the vessels. The forces which modify the exudation of blood through the coats of the vessels are the following:—

1. *The Quantity of Blood circulating in the Vessels.* The larger this quantity is, the more the vessels and their pores are distended, and more blood passes into the parenchyma, and *vice versa*. If a fluid be driven through an elastic tube, the latter will be distended in proportion to the force applied.

2. *The Quantity of the Blood-Corpuscles.* Many blood-vessels (*vasa serosa*) are of smaller diameter than the blood-corpuscles; and hence must be distended when they pass through them. It is incorrect, and quite in contradiction to physical laws to assert, with some physiologists, that the corpuscles are compressed and become elongated, in passing through these vessels. Being propelled by a *vis à tergo*, they must become broader, but never more slender. On pressing an elastic globe through an elastic tube, the former will not become thinner, but both will be distended. Hence, the more corpuscles there are in the blood, the more the vessels and their pores are distended.*

3. *The Energy of the Forces which Propel the Blood into the Small Vessels.* The capillaries and their pores are distended in direct proportion to the energy with which the blood is sent into them by the heart and large vessels. This may be demonstrated by forcing, with varied pressing power, a quantity of fluid through an elastic tube.

4. *The Temperature.* Within certain limits, a high temperature favours distension of the vessels, while a low one causes them to contract.†

We find, in the above principles, the explanation of many of the phenomena of health and disease.

I. The similarity between the symptoms of *anæmia* and those of *hyperæmia* is evidently accounted for. In both diseases, nutrition is interrupted: in *anæmia*, by want of blood; in *hyperæmia*, by its superfluity, which produces pressure on the tissues, and impedes their power of selection and assimilation. In *hyporæmia*, the vessels are over-distended, and too much blood passes through their coats into the parenchyma.

II. We find an explanation of the general organic weakness which is constantly observed in fevers. The heart being, in these diseases, too energetic in action, the vessels are over-distended, and an excessive quantity of blood is effused, producing effects similar to those which occur in *hyperæmia*.

III. The secretions, as the urine, sweat, and saliva, are impeded in fevers by this pressure of the blood on the textures. In spite of the presence of a large quantity of blood in their parenchyma, the organs are in want of material to furnish the secretions; for they require a large proportion of water, which is not afforded by the blood which passes through the pores of the vessels in a fibrinous state. Bruck's experiments show that a large proportion of water

* Haas (Dr.) Ueber die Function der Blutkörperchen. Oesterreichischer Jahrbücher. Jan. 1848.

† Valentin's Physiologie, band i. sect. 1086.

and soluble salts, and very little albumen, pass through small pores; but that through large pores, such as there are in fevers, there pass very little water and saline matters, and much albumen. The parenchyma of the secreting organs, then, contains very little water in fevers. This impediment to the secreting functions causes the retention in the blood of a large quantity of urea, saline matter, etc.; but after the fever had subsided, when the action of the heart has diminished, and the vessels are less distended, the quantity of blood is not only diminished, but becomes more watery: the secreting organs are stimulated to action by the matters which have been retained, and the blood is also more able to remove them. The urea and salts increase in the urine, producing a sediment, the appearance of which denotes a *crisis*.

IV. A diminution in the quantity of blood is the cause of the summer sleep of the amphibia. Berthold and Davy found the temperature of these animals always lower than that of the atmosphere; this is produced by the evaporation of water from their bodies increasing with the temperature. Hence, in a high temperature, the quantity of blood in these animals is much diminished by their losing a large quantity of water; and in circulating through the vessels, it does not distend them sufficiently to allow the nutritive part to exude. Nutrition, then, being partially suspended, the animals fall into a lethargic state. This explanation is in accordance with the fact that the amphibia creep into a hiding-place in dry, and awake in wet weather. They are not awaked by being carried into a cold room, but by being immersed in water.

V. A similar explanation will account for the fact that animals are unable to live longer than twenty days on dry food, without any fluid, while they can exist for fifty days when supplied with water alone, but in sufficient quantity. As long as the animals get no fluid, the blood loses water daily in the urine, saliva, sweat, and breath. This loss can never be repaired by dry food, for the stomach cannot digest a sufficient quantity. The blood, thus reduced in quantity, passes through the vessels without being able to distend them, and afford nutritive material, as in the summer sleep of amphibia. The want of water also causes a thickening of the blood, which co-operates with its want of power to distend the vessels. But if the animals are supplied with a sufficient quantity of water, without any food, they survive for a longer time. Although water contains no nutritive material, and cannot be transformed into nervous or muscular tissue, it nevertheless indirectly contributes to nutrition, by increasing the quantity of the blood. The vessels are sufficiently distended, and the blood passes into the parenchyma, and supports life longer, in spite of its possessing very low nutritive power.

VI. The winter-sleep of animals has its origin, like the summer-sleep, in an interruption to nutrition. The summer-sleep is caused by the loss of water; the winter-sleep by the diminished activity of the heart's action, consequent on the influence of cold. It has been found that, in hibernating animals, at the commencement of the winter-sleep, the pulsations of the heart subsided from 200 to 50 in a minute. The heart being thus weakened, is not able to propel the blood with sufficient force to distend the vessels, which are much more contracted in cold weather. In such circumstances, no blood passes through the pores into the parenchyma, nutrition is interrupted, and the animals fall into a state of asphyxia, losing the power of feeling and perceiving. The reason why some animals only are subject to hibernation is to be found in their various degrees of sensibility. Those whose heart is unable to resist the weakening influence of cold, are seized on by winter-sleep. This explanation is confirmed by the fact, that we observe young animals asphyxiated by a degree of cold, which they would bear with impunity if full grown. Legallois observed this in rabbits, six or eight weeks old.

The cold-blooded animals are also very soon overpowered by cold; but this is dependent on two causes. Not only are they more susceptible of the influence of cold, but their small quantity of blood acts at a disadvantage. The quantity of blood would be sufficient, if the heart acted with sufficient energy; but the heart's action failing, the blood merely circulates in the vessels, without being able to pass through their coats.

VII. The diminished activity of the heart, and the contraction of the vessels, in cold weather, explain why we are compelled to take a larger quantity of food in winter, or when living in a cold climate. We endeavour to supply the want of one force which contributes to nutrition, by increasing others—to make up for the insufficient action of the heart by increasing the quantity of blood. If a fluid be pressed through an elastic tube, its walls will be less distended as the force is diminished, but more distended if the quantity of fluid be increased. If the quantity of fluid be increased in the same proportion as the propelling force is decreased, the distension of the vessels remains the same. The degree in which cold impedes nutrition may be observed in the inhabitants of the frigid zones. They are stunted in growth; their bodies are short, their muscles thin, their senses obtuse, their mental faculties very weak, and the sexual instinct, the catamenial flow, and the fecundity, are much less than in other people. The same quantity of blood which is sufficient for nutrition in a warm climate is not so in a cold one. In the latter, also, the heart is less active, and the vessels more contracted. For effecting adequate nutrition, a certain quantity of blood must pass into the parenchyma; and if the heart cannot act with sufficient energy to propel sufficient blood to distend the vessels, the absolute quantity of blood must be increased: otherwise a general stinting of growth results.

As the blood is the carrier of animal heat, we encourage by increasing its quantity, and especially its penetration through the walls of the vessels, not only the nutrition of the tissues, but also the sensation of external warmth. We possess more blood in winter than in summer, and are hence more disposed to inflammation in the former season. We more easily, and for the same reason, bear a high temperature in the winter than in the summer. Warmth excites the heart's action, and promotes distension of the vessels; and if these at the same time contain much blood, congestions and inflammations are liable to occur.

The opinion of Liebig, that we are obliged to eat more in winter than in summer, because we inspire more oxygen, is not adequate to explain the facts above referred to: 1. According to Liebig, we possess in summer more blood than in winter, in which latter season the oxygen consumes more of the blood. If it were so, the tendency to inflammation ought to be greater in summer than in winter. 2. It ought not to be easier to bear a high temperature in summer than in winter. 3. Liebig's view does not explain why the amphibia and young animals become more easily asphyxiated in cold weather. The oxygen cannot have consumed a sufficient quantity in such a short time. 4. If an organ be subjected to the influence of cold, it loses sensation as if deprived of blood.

VIII. The same instinct which compels us to take more food in winter also invites us in the same season to make use of spirits. These, by exciting the heart to more frequent and energetic contraction, directly oppose the influence of cold, which weakens the heart, and prevents it from contracting with energy. By increasing the activity of the heart's action, spirits cause the greater distension of the vessels, and thus contribute to the nutrition of the organs. But, though to a certain extent equivalents to food, they never contribute directly to textural nutrition.

The protection which spirits afford against cold is produced by the diffusion of animal heat by means of the effusion of blood into the parenchyma. Liebig explains this phenomenon by the evolution of warmth from the combustion of spirits by the oxygen: but this opinion is liable to the following objections: 1. If the increase of animal heat by the use of spirits were dependent on this chemical action, the same quantity of spirits should produce the same amount of heat in all persons. But experience shows that this is not the case. Individuals, who are not accustomed to spirits, feel very warm, and even perspire on taking a small quantity, while those who are addicted to their use feel no effect from the same quantity. This agrees entirely with the statement above given, that the effect produced by spirits is the consequence of their stimulating action on the heart: 2. Spirits are never burnt at such a temperature as is generally found in animals: 3. They are expired generally by the lungs, and not therefore burnt: 4. Fat is likewise burnt as by the oxygen; and yet we do not feel warmer after making use of it.

In the preceding theory, we find the explanation of the fact that drunkards live on a small quantity of food. A small quantity of blood affords as much nutrition to them as a larger quantity to other persons; for, in consequence of their taking spirits, the heart propels this small quantity of blood into the small vessels with such energy, that they are as much distended by it as by more blood with the normal activity of the heart. After having abstained from spirits for some hours, the drunkard feels very weak, and is not better till he has again taken liquor. He does not feel strengthened by taking food, as other individuals do. The reason of this is his general *anæmia*. By the use of spirits the heart is caused to propel the blood forcibly, so as to distend the vessels, and the tissues are nourished. But the stimulus being removed, the activity of the heart subsides to its normal standard; the blood in the parenchyma is partly consumed by the tissues, partly absorbed by the lymphatic vessels. As the normal activity of the heart is insufficient to propel the small quantity of blood, the tissues are soon in want of food: hence the individual feels weak. But the simple use of food cannot strengthen him, because the quantity of blood cannot be restored with sufficient rapidity, as has been explained in my observations on the starving of animals by the use of dry food. The drinking of water or other fluids is more effectual than taking food. The quantity of blood is increased; and the vessels and their pores being distended, nutritive material is more exuded into the parenchyma. In this way we may explain the cure of *delirium tremens* by drinking a large quantity of water. The want of appetite in drunkards is a natural consequence of the chronic inflammation of the stomach.

IX. In the same manner as spirits, warmth supports animal life. Animals partially starved, and already insensible, can be roused by artificial warmth. After ten minutes, the animal rises up, takes food, passes feces and urine; and is, during the application of warmth, lively and merry. Warmth excites the heart and distends the vessels; so that the blood, in spite of being reduced by fasting to a very small quantity, passes through the walls of the vessels more readily than before heat was applied. In this way the tissues obtain nutritive material; and the organs again recover their activity.

X. But animals die sooner after being subjected to artificial warmth than when left insensible. This is to be explained by the same remarks as I have made in speaking of summer-sleep, and of the starving of animals when restricted to the use of dry food. In all these circumstances, the animals die from the want of blood in the parenchyma, produced by the loss of water. For when awaked they part with a large quantity of water in the urine, sweat, and breath; all which secretions are, like the nutritive material, furnished by the blood. The blood is thus much more diminished than if the animals had been left in their state of asphyxia. Chossat asserted that pigeons which were undergoing starvation lost twice as much weight when roused by artificial warmth as when left quiet.* This is more the effect of secretion than of the process of nutrition.

XI. In the principles which I have laid down, we find an explanation of the changes which the blood undergoes under various circumstances. There can be no doubt that any impediment to the process of nutrition must produce an alteration in the blood in the vessels; for those materials which ought to be applied to nutrition, and transformed into different textures, remain in the blood. If being established that the quantity of blood in the vessels, the number of blood-corpuscles, the energy with which the propulsive agents in the circulation act, and the amount of temperature, produce modifications of the nutritive process, it is equally probable that they tend to alter the blood in the vessels.

In order to show what parts of the blood increase with the augmentation, and decrease with the diminution of nutrition, we must show what materials are subservient to this process. These are, besides some salts, fibrin and albumen. The corpuscles, being unable to pass through the walls of the vessels, cannot be considered as affected by the increase or diminution of nutrition.

The albumen and fibrin, though both subservient to nutrition, are destined for distinct purposes. The fibrin nourishes the tissues: but the albumen is

* Chossat. *Recherches sur l'Inanition*, p. 121.

transformed into fibrin and corpuscles. That the blood-corpuscles are formed from albumen, is proved by considering that they must be formed *in* the vessels, as they cannot pass through their pores; and as they are similar in composition to albumen, they are without doubt formed of it. That the fibrin is formed from albumen can be demonstrated by the following facts: 1. The chyle contains more albumen and less fibrin than the blood; consequently, a part of the albumen must have been transformed into fibrin. 2. The chyle, immediately after being absorbed by the lacteal vessels from the intestines, contains more albumen and less fibrin than that which has passed through the mesenteric glands. 3. Lymph contains much more fibrin, and less albumen, than blood-serum. But as the lymph is formed in the parenchyma of the organs from the blood-serum, which contains but little fibrin, the fibrin in it must be formed from albumen. 4. The arterial blood contains more fibrin, and less albumen than the blood in the veins; and this can only result from the transformation of the latter material into the former.

The albumen is therefore not only consumed for the purposes of nutrition, but is in a great measure transformed into fibrin and blood-corpuscles. Hence any increase or decrease in the quantity of albumen is not only dependent upon the various degrees of activity of the nutritive process, but also on the extent to which it is transformed into fibrin and blood-corpuscles. If this action be impeded, the albumen must, if it be restored by food, increase in quantity, in spite of the apparent performance of textural nutrition.

Fibrin differs from albumen, in its mode of reparation. Albumen is only restored by food; and if none be taken, the albumen is not renewed. But fibrin, being formed from albumen, is restored even if no food be taken. It is nevertheless to be remembered that the chyle also contributes a share to the formation of fibrin.

We are now able to point out some laws which regulate the increase or diminution of the albumen and fibrin.

The albumen increases: 1. When food is taken as before, if either the nutrition of the textures, or the formation of blood-corpuscles or of fibrin be impeded. In consequence of this, the albumen increases: (a) In chlorosis, where the formation of blood-corpuscles is impeded by the want of iron, or from some other cause. But if less food be taken than before, the albumen cannot be increased. (b) In many toxæmic diseases, as typhus, intermittent fever, bilious fever, &c., the poisons of these diseases in general impede the formation of fibrin;* and if the attack takes place on the same day on which food has been taken, the albumen will be restored by the chyle, and must increase. But if an animal be seized after fasting for some days, or if the blood be drawn three or four days after the toxæmic influence have first acted, we shall not find an increase of the albumen. The influence of food accounts for the albumen being sometimes in excess in chlorosis, and in toxæmic diseases, and sometimes in defect. 2. If, while the nutrition of the textures, and the formation of corpuscles and fibrin, are performed as before, more food is taken. In consequence of this, the albumen is increased in plethora.

The fibrin increases: 1. If, while it is being formed as before, nutrition is impeded. In consequence of this it increases: (a) In all inflammatory fevers, where nutrition is impeded by the violence of the circulation, but where no cause operates to retard the formation of fibrin, which is still formed from albumen, even though very little food be taken. (b) After bleeding, when nutrition is impeded by the blood not being in sufficient quantity to distend the vessels. This increase is only relative in proportion to the other parts of the blood; the loss of all parts has been equal, but the fibrin is soonest restored. The blood-corpuscles require time for renewal, and the albumen can only be supplied by food. (c) In abstinence, where the albumen is not restored by food, but the fibrin continues to be formed from albumen, the same phenomenon takes place as after bleeding. (d) In all diseases in which the blood-corpuscles are diminished, the vessels are not distended sufficiently to allow the fibrin to

* It does not follow that every poison impedes the formation of fibrin; for all poisons are not alike.

pass into the parenchyma of the various organs. This is the case in chlorosis, scirrhus, morbus Brightii, the latter mouths of pregnancy, and tuberculosis. Under all these circumstances, an access of fever determines an increase in the quantity of fibrin. 2. If, when the formation of fibrin continues to be performed as before, a large quantity of fibrinous food be taken. This is the result of an animal diet; for in this case, the chyle contains much more fibrin than when a mixed diet is used.

The albumen decreases whenever its expenditure is greater than its supply by the food. This takes place in fasting; where, though but little albumen passes through the coats of the vessels, it is consumed in the formation of fibrin and corpuscles.

The fibrin decreases only if its formation be impeded. This takes place in various narcotizations and poison-diseases, as poisoning by opium, hydrocyanic acid, typhus, miasma, etc.

It is here the place to refer to the causes of the increase or decrease of the blood-corpuscles in different diseases. We have first to point out how they are *spoiled*, in the healthy state. On this point, we have only hypothetical ideas: but, as it is established that the small vessels are distended by the passage of the corpuscles, an amount of friction must be exercised, which must tend to render the corpuscles unfit for use. It follows, that the oftener the corpuscles circulate through the vessels, the more they are spoiled; but this rule is not without exceptions. It may happen, that the corpuscles are often propelled through the vessels without being injured; this occurs if the walls of the vessels are soft and capable of yielding. In this case, the corpuscles must increase, if their formation be not impeded. They must decrease, if their formation be impeded, or the vessels be resistant, and the heart act more frequently. Hence they decrease in fevers, because the contractions of the heart are more frequent. They increase in typhus and other toxæmic diseases, where the vessels are yielding, which is denoted by the softness of the pulse; for, as the vessels do not resist the pressure of the finger from without, they cannot be supposed to oppose the pressure from within. This is the result of the action of the poison. If, however, the formation of the corpuscles be impeded, they decrease notwithstanding the softness of the vessels. This sometimes happens in chlorosis.

XII. From the preceding observations, we can understand the cause of the different characters of the exuded matter in inflammation and in congestion; the product of congestion being non-fibrinous, while that of inflammation contains much of this substance. Pathologists have ascribed this phenomenon to different *dyscrasies*, which, according to the preponderance of fibrin or albumen in the exudation, they have termed the fibrinous or albuminous dyscrasies. These are only hypothetical, and are incapable of demonstration, either *à priori* or *à posteriori*. The retention of the fibrin in the blood, and its free exudation through the pores of the vessels, depend, as I have already shown, on the state of distension of the capillary vessels, and upon the various substances which are mixed with the blood. If the blood contain substances which impede the formation of fibrin, as is the case in typhus and other toxæmic diseases, the fibrin must decrease, and the exuded matter cannot contain much of it. The amount of albumen in the exudations also depends on the distension of the vessels, and on the quantity in the blood. In cases where the blood has not been poisoned, the exuded matters will contain a quantity of fibrin, proportionate to the distensions of the vessels of the inflamed part. Hence all those causes which assist the distension of the vessels also promote the exudation of fibrin. In persons with much blood, containing many corpuscles, and with increased action of the heart, an exudation of much fibrin is produced; while in feeble individuals, possessing a small quantity of blood, poor in corpuscles, and in whom the heart acts feebly, and the vessels are not distended, the exudation will contain but little fibrin, although the blood be rich in it. When some poison impedes the formation of fibrin, as in typhus, etc., the exuded matter contains much albumen.

In winter, the body generally contains more blood, and the exudation is more fibrinous, from the distension of the vessels by the greater quantity of the blood. In summer, the body contains less blood, the vessels are less distended,

and the exuded matter is poor in fibrin. In childhood, where a great part of the blood is employed in the evolution of the organs, only a small quantity remains in the vessels, as is proved by our finding it only in the larger veins and in the heart; the matters exuded contain very little fibrin, the vessels being very little distended. Moreover, the blood in the child contains a smaller proportion of fibrin than that of the adult, on account of the greater amount of vegetables in the food.* In chlorosis, in spite of the presence of much fibrin in the blood, the exuded matters contain but little of it. The reason of this is the non-distension of the vessels, from the deficiency of blood-corpuscles. In typhus and other toxæmic diseases, the exuded matter contains very little fibrin, the blood being poor in it; but it contains much albumen. But the condition of the vessels has also a great influence on their power of distension and hence on the quality of the exuded fluid.

XIII. From the preceding observations, the following practical rules may be deduced:—

A. In all diseases where there is an indication to increase the penetration of the blood through the pores of the vessels into the parenchyma of the organs, we must use means to augment the quantity of the blood and of its corpuscles, the activity of the heart and large vessels, and the animal heat.

The quantity of the blood is increased: *a.* By taking a large quantity of aliment: either by the stomach, if it be able to digest a sufficient amount; or by nutritive baths and enemata. *b.* By the ingestion of a large quantity of water, either by drinking or by enemata. Although the water is soon removed by the kidneys, it must in any case first enter into the blood-vessels; for it is unreasonable to imagine the existence of *viæ claudescentes*, leading directly from the stomach to the kidneys. While, then, the water is in the vessels, these are more distended, and a larger amount of the nutritive part of the blood passes into the tissues. That water remains for some time in the vessels, and is not immediately removed by the kidneys, can be proved from the following experiment. If one animal be bled six hours after drinking, and another only half an hour after, the blood of the latter will be found much more watery than that of the former. The retention of the water in the blood for some time previous to its elimination is also proved by the circumstance that a sweat breaks out on the surface of the body, after drinking several glasses of water; and also by the fact that animals will survive for some time when supplied with water alone. In the latter case, it can only act by increasing the quantity of the blood.

The number of blood-corpuscles is increased by the use of iron; as is proved by the observations of Andral and Gavarret.

The activity of the heart and of the vessels is increased: *a.* By exercise. This is proved by the well-known circumstance that, in violent motion of the body, the activity of the heart is much increased, the vessels are more distended, and a sweat breaks out on the surface of the body. *b.* By the use of spirits and of various other stimulants.

The temperature of the body is increased by means of warm clothing, by warm baths, by warming the air which surrounds the body and by friction.

If one of the forces which assist the exudation of the nutritive part of the blood be diminished, its deficiency must be compensated by the increase in intensity of the others. Hence, after losses of blood, we administer spirits with water, apply friction, and employ means for producing warmth: we also give iron and use baths containing nutritious matters, and advise the patient to take exercise if he be not too weak. We follow the same plan after long abstinence from food, and in convalescence from diseases of long standing; and the same thing is to be done in chlorosis. The asphyxia produced by cold arises from the want of nutrition; hence the same remedies are to be employed. In these cases, water, spirits, artificial warmth, iron, and exercise, act as equivalents to food. This may be witnessed in animals, confined to the use of water, which are revived from their apathetic state by artificial warmth; in drunkards, who live on a very small quantity of food; and in chlorotic patients, who gain

* Leluman, Physiolog. Chemie, 1842, bd. i. p. 194.

strength from the use of iron, and from exercise. After loss of blood, spirits are the best remedy, as they seem to cause an increased flow of blood in the vessels of the brain, which is thus kept in a sufficient state of stimulation, in spite of the small quantity of blood in the vessels.

It will be in place here to answer some objections to the use of spirits, from the effects, real or supposed, produced by them in drunkards. In these persons, the blood is thick and dark coloured. The thickness arises, not from the coagulation of the albumen by the blood,* as Budge and others suppose, but from the large quantity of fat contained in the blood. The dark colour has its rise in the impaired power of the heart and lungs, by which the circulation is impeded, and the carbonic acid is not sufficiently removed from the blood. But all this is far from being a legitimate object of dread, in the moderate use of spirits.

Remedies which increase the exudation of the blood are also to be employed in catarrhal inflammation. The process which here takes place is as follows. Distension of the vessels of the mucous membrane being produced by any cause, the blood stagnates in the vessels; but as it is pressed on by the blood, which is still flowing, it is obliged to pass through the pores of the vessels, as far as the cells of the epithelium, by which it is prevented from passing out. After some time, the epithelium becomes relaxed, and the thinner part of the blood is enabled to exude through its cells, in the form of a thin mucus. Subsequently, the epithelium, being quite spoiled, is thrown off, and the thicker part of the exuded blood escapes. When the part is thus freed from the exudation, the pressure is removed and a new epithelium is formed; after which the part is restored to the healthy exercise of its functions. The sooner, therefore, the epithelium can be removed, the sooner recovery takes place; and this occurs in proportion to the rapidity with which the blood in the congested vessels can be caused to exude. In this first stage, spirits or other stimulants, warmth, cold water or vigorous exercise, are the best remedies. But when the thickened mucus has begun to appear, showing the removal of the epithelium, remedies of another character are indicated.

B. In all cases where exudation is to be retarded, remedies of an opposite character to those before mentioned must be used. We have to diminish the quantity of blood and of blood-corpuscles, the activity of the heart and large vessels, and the temperature of the body.

The quantity of blood and of blood-corpuscles is diminished by bleeding; and we have no means which act so rapidly in decreasing the proportionate quantity of the latter. The blood may also be diminished in quantity by increasing the secretions. All remedies which act as stimulants to the activity of the secreting organs diminish the quantity of the blood. These include laxatives, diuretics, diaphoretics, emetics, and sialagogues. All these remedies

* The assertion of Budge (*Allgemeine Pathologie*), that spirits produce coagulation of the albumen of the blood while in the body, is opposed to experience. They cannot produce this effect in the living body, provided their quantity be kept within certain limits. If they generally had this effect, they would be most active and dangerous poisons; yet we find persons who habitually use them, living to a great age. Orfila having injected alcohol into the veins of animals, found the blood coagulated in the immediate vicinity of the injection, while that in distant parts of the body remained fluid, although as much in contact with the spirit as if the latter had been drunk. We can never assert that substances always produce the same effects in, as out of the body. There are certain circumstances in the living organism, with the nature of which we are not yet acquainted, which are capable of impeding and modifying the chemical action of some substances. The aggregate of these modifying circumstances is termed the *vital force*. As an example of this, the blood when removed from the body is decomposed by oxygen into carbonic acid, ammonia, hydrosulphuric acid, and water; but in the living body, carbonic acid, urea, uric acid, and water are the products. The oxygen always acts according to chemical laws; but there are certain circumstances in the body which compel it to produce urea and uric acid instead of ammonia. If we knew what these are, we should be able to produce urea and uric acid. We can imitate digestion; but we must use pepsin taken from the stomach, because we are not able to make it artificially.

diminish the blood, but do not produce a decrease in the corpuscles. From the effect of diuretics and diaphoretics, the blood loses only water and saline matters; by emetics, purgatives, and sialagogues, it also loses a portion of albumen.

The activity of the heart is diminished by some narcotics, as digitalis, etc., and by acids. Cold has the effect of increasing the contraction of the vessels, and of diminishing the activity of the heart. Tranquillity is also necessary to be observed.

Bleeding, which diminishes the blood and its corpuscles, is to be employed in all inflammations, when the exuded matter cannot be thrown out, but not in individuals who are exhausted and very much weakened. By this operation, we not only diminish the exudation, but we render it more watery, and capable of dissolving the old exudation, so that it may be absorbed. The vessels are not so much distended, and thus less albumen and fibrin, and more water and salts, penetrate into the parenchyma. But in exhausted and weakened persons, where there is only a small quantity of blood, and the fibres of the tissues are relaxed and soft, bleeding may be followed by dropsy, from the exudation of water and saline matters through the lax fibres. Dropsical symptoms appear generally after the subsidence of fever: because while the fever is active, the energy of the heart causes the vessels to be kept distended, so that the exuded matter is albuminous, and is too thick to pass between the fibres of the tissues. But when the fever is past, the activity of the heart subsides; and the quantity of the blood being small, the vessels are very little distended, so that only water and saline matters exude, and by gravitation tend to the lower parts of the body.

The remedies which increase the secretions and excretions act altogether in another way: particularly diuretics and diaphoretics, by the action of which the blood loses water and saline matter. The blood becomes thickened like cholera-blood. In such circumstances, scarcely any water passes through the pores of the vessels into the parenchyma of the organs. The effect, therefore, is quite opposite to that produced by bleeding.

It is easy to understand how, though bleeding and evacuant remedies both diminish the quantity of the blood, they cannot be always used in the same circumstances. In inflammations with fever, in robust and athletic individuals, where the exudation contains much fibrin and albumen, and is deficient in water, so that it requires a new watery exudation to dissolve and absorb it, bleeding which promotes such an exudation of water will be most useful. But evacuants, which impede the exudation of watery matter, protract the disease. But in inflammation without fever, or in exhausted and bloodless individuals, where the exudation is not thick, and wants no other exudation to render it soluble, bleeding is either superfluous or dangerous, while the evacuants mentioned above are useful. The same is the case in inflammations of those parts where the exudation is in general only watery. In the same way, evacuants are remedies against dropsical diseases, by diminishing the exudation of water. The water which has been already exuded will be absorbed, if the lymphatic vessels are in a state of health. The lymphatic vessels, after having absorbed the exuded serum, bring it back to the blood; and so the blood becomes thin in spite of its losing much water by the use of evacuants. But if the lymphatic vessels of the part where the inflammation is are unable to absorb the exuded liquid, and to return it back to the blood, this must become, by the continuous use of evacuants, very thick, so that very little can pass through the vessels. The individual must become weak, and the lymphatic vessels of the whole body having no blood to absorb, must absorb the fat of the organs; and this is the reason that, under the use of evacuants in dropsy, if the dropsical tumour do not decrease, the fat in the whole body gradually disappears. Evacuants act most beneficially in all chronic inflammations. In these diseases, the vessels are generally unable to contract; but the blood is not entirely stagnant. By the use of evacuants the quantity of blood is diminished, and the vessels are less distended, so that they have an opportunity of being restored to their functions. Evacuants are to be given in cases of hypertrophy, especially in

that of the heart. Bleeding is sometimes beneficial: but it is liable to induce dropsy, which does not follow the use of evacuations.

I do not desire to be a panegyrist of purgatives, as I consider that they are not only used sufficiently, but even too often, and without sufficient reason. But I think that diuretics, and probably diaphoretics, should be more used than they are at present. The perspiration consists of water and carbonic acid, and amounts to thirty-four ounces in twenty-four hours; being the same quantity of water as is removed by the kidneys.

If the normal perspiration, which disappears without being noticed, amounts to thirty-four ounces, it is obvious, that the increasing perspiration, which appears in the form of sweat, must be in great quantity. We are therefore able to diminish the quantity of blood in a very considerable degree by diaphoretics. This is the reason why we feel very weak after sweating any time, for the quantity of blood is very much diminished, and the same effect is produced as after a large loss of blood by bleeding.

I think the cold-water cure acts merely as a diaphoretic. The vessels of the cutis being first contracted by the cold, become, by being excited, very weak, as is the case after every application of a strong stimulus. They become lax and distended, and a great sweat follows: during this, the cold bath is repeated, and the vessels, which are yet not quite restored, are again excited. The relaxation of the vessels must now occur to a greater degree than before; and the sweat does not cease for several hours. Besides this, we must remember the exercise which the patients take in climbing hills, etc. The vessels of the cutis are relaxed to such a degree, that even a stasis of the blood takes place in some parts of the cutis, and spontaneous blisters are produced. Warm bath produces relaxation of the vessels of the cutis, but not in such a marked degree as cold applied in the way just mentioned. Sweating baths act in the same way. By these different kinds of baths, we are enabled to rapidly diminish the quantity of blood without danger of dropsy. They have doubtless other effects; but the diminution of the quantity of blood is the first.—*Lond. Journ. Med.*, July and August, 1850.

MATERIA MEDICA AND PHARMACY.

9. *The Kouso, or Brayera Anthelmintica*. By JONATHAN PEREIRA, M.D.—The Kouso, or Brayera Anthelmintica, is an Abyssinian tree twenty feet high. Branches round, rusty, tomentose-villose, marked by the annular cicatrices of the fallen leaves. Leaves crowded, alternate, interruptedly impari-pinnate and sheathing at the base. Leaflets oblong, or elliptical lanceolate, acute, serrate, villose at the margin and on the nerves of the under surface. Stipules adnate to the petiole, which is dilated at the base and amplexicaul. Flowers dioecious, small, greenish, and becoming purple; repeatedly dichotomous; the pedicels with an ovate bract at the base.

The so-called male flowers may be regarded as hermaphrodite flowers, inasmuch as the carpels are well developed. The female flowers are somewhat different in their structure. The outer segments of the calyx are much more developed than in the female flowers, and are four or five times larger than those of the inner row, and are placed somewhat below them; the petals are entirely wanting; the stamens are rudimentary and sterile. The ripe fruits are unknown.

The tree grows in Tigre, Agame, and Shoa; it is cultivated everywhere, and Dr. Beke writes that the tree is "found throughout the entire table land of North-Eastern Abyssinia, but appears to require an elevation of upwards of six thousand (perhaps of seven thousand) feet for its growth. Where I found it most luxuriant was in the vicinity of the source of the river Abai (Bruce's Nile), at an elevation of close upon nine thousand feet. Tigre, the northern portion of Abyssinia, being on the whole of lower elevation than the rest of that country, the tree is only found there in a few places."